

Feasibility and Plan of Operation Report for a Hazardous Waste Storage Facility

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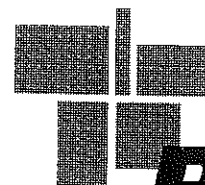


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Notice of Completeness & Preliminary Determination Response dated November 10, 1995
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ATTACHMENT 15: PLAN SHEETS

PLAN SHEETS

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ATTACHMENT 16: DESIGN SPECIFICATIONS

TANK PUNCTURE CALCULATIONS

EROSION CONTROL

STRESS CALCULATIONS

STRUCTURAL & STRESS CALCULATIONS

SIDEWALL & BOTTOM STRUCTURE AND CORROSION CALCULATIONS

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TANK PUNCTURE CALCULATIONS

TANK PUNCTURE LEVEL (ft)	AVAILABLE HEAD (ft)	HORIZONTAL VELOCITY ft/sec	DISTANCE TO TOP OF 3'-6" HIGH CONTAINMENT (ft)	TIME REQUIRED TO FALL TO TOP OF CONTAINMENT (sec)	HORIZONTAL DISTANCE TRAVELED (ft)
7'-0	7.0 ft	21.23 ft/sec	3.5 ft	.466 sec	9.89 ft
6'-6	7.5 ft	21.98 ft/sec	3.0 ft	.432 sec	9.50 ft
6'-0	8.0 ft	22.70 ft/sec	2.5 ft	.394 sec	8.94 ft
5'-6	8.5 ft	23.40 ft/sec	2.0 ft	.352 sec	8.29 ft
5'-0	9.0 ft	24.07 ft/sec	1.5 ft	.305 sec	7.34 ft
4'-6	9.5 ft	24.73 ft/sec	1.0 ft.	.249 sec	6.16 ft
4'-0	10.0 ft.	25.38 ft/sec	.5 ft.	.176 sec	4.47 ft

DEVELOP CHART

TANK PUNCTURE LEVEL	AVAILABLE HEAD (ft)	HORIZONTAL VELOCITY (ft/sec)	DISTANCE TO TOP OF 3'-6" HIGH CONTAINMENT (ft)	TIME REQUIRED TO FALL TO TOP OF CONTAINMENT (sec)	HORIZONTAL DISTANCE TRAVELLED ft
14'-0	0 ft	0 ft/sec	10.5 ft	.808 sec	0 ft
13'-6	.5 ft	5.67 ft/sec	10 ft	.788 sec	4.47 ft
13'-0	1.0 ft	8.02 ft/sec	9.5 ft	.768 sec	6.18 ft
12'-6	1.5 ft	9.83 ft/sec	9.0 ft	.748 sec	5.50 ft
12'-0	2.0 ft	11.35 ft/sec	8.5 ft	.727 sec	6.18 ft
11'-6	2.5 ft	12.69 ft/sec	8.0 8.0 ft	.705 sec	8.95 ft
11'-0	3.0 ft	13.90 ft/sec	7.5 7.5 ft	.683 sec	9.49 ft
10'-5	3.5 ft	15.01 ft/sec	7.0 ft	.659 sec	9.89 ft
10'-0	4.0 ft	16.05 ft/sec	6.5 ft	.635 .635 sec	10.19 ft
9'-6	4.5 ft	17.02 ft/sec	6.0 ft	.610 sec	10.38 ft
9'-0	5.0 ft	17.94 ft/sec	5.5 ft	.584 sec	10.48 ft
8'-6	5.25 ft	18.39 ft/sec	5.25 ft	.571 sec	10.50 ft
8'-6	5.50 ft	18.82 ft/sec	5.0 ft	.557 sec	10.48 ft
8'-0	6.0 ft	19.66 ft/sec	4.5 ft	.529 sec	10.39 ft
7'-6	6.5 ft	20.45 ft/sec	4.0 ft	.498 sec	10.18 ft

U) AT 4'-0 LEVEL, $h = 10$ FT

$$\begin{aligned} v_0 &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(10)} \\ &= 25.38 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT =

$$\begin{aligned} 4 - 3.5 &= 16.1 t^2 \\ .176 \text{ SEC} &= t \end{aligned}$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.176 \text{ SEC})(25.38 \text{ FT/SEC}) = 4.47 \text{ F}$$

MAXIMUM HORIZONTAL DISTANCE OCCURS BETWEEN 8'-6 LEVEL AND 9'-0 LEVEL. CHECK 8'-9 LEVEL

AT 8'-9 LEVEL, $h = 5.25$ FT

$$\begin{aligned} v_0 &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(5.25)} \\ &= 18.39 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT =

$$\begin{aligned} 8.75 - 3.5 &= 16.1 t^2 \\ .571 \text{ SEC} &= t \end{aligned}$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.571 \text{ SEC})(18.39 \text{ FT/SEC}) = 10.5$$

S) At 5'-0 LEVEL, $h = 9.0$ FT

$$\begin{aligned} V_o &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(9.0)} \\ &= 24.07 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT

$$5 - 3.5 = 16.1 t^2$$

$$.305 \text{ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELLED} = (.305 \text{ SEC})(24.07 \text{ FT/SEC}) = 7.34$$

T) At 4'-6 LEVEL, $h = 9.5$ FT

$$\begin{aligned} V_o &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(9.5)} \\ &= ~~24.07~~ 24.73 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT

$$4.5 - 3.5 = 16.1 t^2$$

$$.249 \text{ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.249 \text{ SEC})(24.73 \text{ FT/SEC}) = 6.16$$

Q) AT 6'-0 LEVEL, $h = 8.0$ FT

$$\begin{aligned} v_o &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(8.0)} \\ &= 22.70 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT =

$$6 - 3.5 = 16.1 t^2$$

$$.394 \text{ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.394 \text{ SEC})(22.70 \text{ FT/SEC}) = 8.94 \text{ FT}$$

R) AT 5'-6 LEVEL, $h = 8.5$ FT

$$\begin{aligned} v_o &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(8.5)} \\ &= 23.40 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT

$$5.5 - 3.5 = 16.1 t^2$$

$$.352 \text{ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.352 \text{ SEC})(23.40 \text{ FT/SEC}) = 8.24$$

O) At 7'-0 LEVEL, $h = 7.0$ FT

$$\begin{aligned} v_0 &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(7)} \\ &= 21.23 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT

$$7 - 3.5 = 16.1 \text{ FT}^2$$

$$.466 \text{ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.466 \text{ SEC})(21.23 \text{ FT/SEC}) = 9.89 \text{ FT}$$

P) At 6'-6 LEVEL, $h = 7.5$ FT

$$\begin{aligned} v_0 &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(7.5)} \\ &= 21.98 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT

$$6.5 - 3.5 = 16.1 \text{ FT}^2$$

$$.432 \text{ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.432 \text{ SEC})(21.98 \text{ FT/SEC}) = 9.50 \text{ FT}$$

m) AT 8'-0. LEVEL, $h = 6.0$ FT

$$\begin{aligned} v_0 &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(6)} \\ &= 19.65 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT =

$$8 - 3.5 = 16.1 \text{ } t^2$$

$$.529 \text{ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.529 \text{ SEC})(19.65 \text{ FT/SEC}) = 10.39 \text{ FT}$$

n) AT 7'-6 LEVEL, $h = 6.5$ FT

$$\begin{aligned} v_0 &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(6.5)} \\ &= 20.45 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT

$$7.5 - 3.5 = 16.1 \text{ } t^2$$

$$.498 \text{ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.498 \text{ SEC})(20.45 \text{ FT/SEC}) = 10.18$$

K) AT 9'-0 LEVEL, $h = 5.0$ FT

$$\begin{aligned}V_o &= \sqrt{2gh} \\&= \sqrt{(2)(32.2)(5)} \\&= 17.94 \text{ FT/SEC}\end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT =

$$9 - 3.5 = 16.1 \text{ } t^2$$

$$.584 \text{ SEC} = t$$

$$\text{MAXIMUM DISTANCE TRAVELED} = (.584 \text{ SEC})(17.94 \text{ FT/SEC}) = 10.48$$

L) AT 8'-6 LEVEL, $h = 5.5$ FT

$$\begin{aligned}V_o &= \sqrt{2gh} \\&= \sqrt{(2)(32.2)(5.5)} \\&= 18.82 \text{ FT/SEC}\end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT =

$$8.5 - 3.5 = 16.1 \text{ } t^2$$

$$.557 \text{ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.557)(18.82 \text{ FT/SEC}) = 10.48$$

I.) AT 10'-0 LEVEL, $h = 4.0$ FT

$$\begin{aligned} V_o &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(4.0)} \\ &= 16.05 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT =

$$10.0 \text{ FT} - 3.5 \text{ FT} = 16.1 t^2$$

$$.635 \text{ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.635 \text{ SEC})(16.05 \text{ FT/SEC}) = 10.19$$

J.) AT 9'-6 LEVEL, $h = 4.5$ FT

$$\begin{aligned} V_o &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(4.5)} \\ &= 17.02 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT =

$$9.5 - 3.5 = 16.1 t^2$$

$$.610 \text{ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.610 \text{ SEC})(17.02 \text{ FT/SEC}) = 10.38$$

G.) AT 11'-0 LEVEL, $h = 3.0$ FT

$$\begin{aligned} v_o &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(3)} \\ &= 13.90 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT =

$$11.0 \text{ FT} - 3.5 \text{ FT} = 16.1 \text{ FT}^2$$

$$\begin{aligned} &.683 \\ &\text{SEC} = \pm \end{aligned}$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.683 \text{ SEC})(13.90 \text{ FT/SEC}) = 9.49 \text{ FT}$$

H.) AT 10'-6 LEVEL, $h = 3.5$ FT

$$\begin{aligned} v_o &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(3.5)} \\ &= 15.01 \text{ FT/SEC} \end{aligned}$$

TIME REQUIRED TO FALL TO TOP OF CONTAINMENT =

$$10.5 \text{ FT} - 3.5 \text{ FT} = 16.1 \text{ FT}^2$$

$$.659 \text{ SEC} = \pm$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.659)(15.01) =$$

E.) AT 12'-0 LEVEL, $h = 2.0$ FT

$$\begin{aligned}V_0 &= \sqrt{2gh} \\&= \sqrt{(2)(32.2)(2.0)} \\&= 11.35 \text{ FT / SEC}\end{aligned}$$

TIME REQUIRED TO FALL $12.0 \text{ FT} - 3.5 \text{ FT} = 8.5 \text{ FT}$

$$8.5 \text{ FT} = 16.1 t^2$$

$$.727 \text{ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.727 \text{ SEC})(11.35 \text{ FT/SEC}) = 8.25 \text{ FT}$$

F.) AT 11'-6" LEVEL, $h = 2.5$ FT

$$\begin{aligned}V_0 &= \sqrt{2gh} \\&= \sqrt{(2)(32.2)(2.5)} \\&= 12.69 \text{ FT / SEC}\end{aligned}$$

TIME REQUIRED TO FALL $11.5 \text{ FT} - 3.5 \text{ FT} = 8.0 \text{ FT}$

$$8.0 \text{ FT} = 16.1 t^2$$

$$.705 \text{ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.705 \text{ SEC})(12.69 \text{ FT/SEC}) = 8.95 \text{ FT}$$

c) At 13'-0 LEVEL, $h = 1.0$ FT

$$\begin{aligned}
 v_0 &= \sqrt{2gh} \\
 &= \sqrt{(2)(32.2) 1} \\
 &= 8.02 \text{ FT/SEC}
 \end{aligned}$$

TIME REQUIRED TO FALL ~~13 FT~~ 13 FT - 3.5 FT = 9.5 FT

$$9.5 \text{ FT} = 16.1 t^2$$

$$.768 \text{ ~~SEC~~ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.768 \text{ SEC}) (8.02 \text{ FT/SEC}) = 6.16 \text{ FT}$$

D) At 12'-6 LEVEL, $h = 1.5$ FT

$$\begin{aligned}
 v_0 &= \sqrt{2gh} \\
 &= \sqrt{(2)(32.2)(1.5)} \\
 &= 9.83 \text{ FT/SEC}
 \end{aligned}$$

TIME REQUIRED TO FALL 12.5 FT - 3.5 FT = 9.0 FT

$$9.0 \text{ FT} = 16.1 t^2$$

$$.748 \text{ ~~SEC~~ SEC} = t$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.748 \text{ SEC}) (9.83 \text{ FT/SEC}) = 7.37 \text{ FT}$$

- 1) A DROPLET (PARTICLE) OF BLENDED FUEL WILL PROJECT FROM THE SIDE OF ~~THE TANK~~ A POTENTIALLY RUPTURED TANK AT AN ~~INITIAL~~ INITIAL VELOCITY $V_0 = \sqrt{2gh}$ WHEREBY h IS THE HEAD IN FEET OF LIQUID ABOVE THE RUPTURE AND g IS THE GRAVITATIONAL CONSTANT 32.2 FT/SEC^2 . THIS ASSUMES NO LOSS IN VELOCITY DUE TO FRICTION, ~~AND~~ VISCOSITY EFFECTS THAT COULD CONTRIBUTE TO ~~FRICTION~~ OF AIR RESISTANCE THAT WOULD ALSO CONTRIBUTE TO FRICTION. ASSUMING A HORIZONTAL DISCHARGE FROM THE TANK, THE MAXIMUM ~~DISCHARGE~~ HORIZONTAL DISTANCE THAT COULD BE TRAVELED IS THE AMOUNT OF TIME REQUIRED TO FALL THE DISTANCE y TO THE TOP OF THE CONTAINMENT WALL (3.5 FT) . THIS TIME IS REPRESENTED BY THE EQUATION $y = 16.1 t^2$ WHERE $y = h - 3.5 \text{ FT}$ AND t IS MEASURED IN SECONDS. THE STORAGE TANKS HAVE A MAXIMUM WORKING LEVEL = 14.0 FT ; $h_{\text{max}} = 14.0 \text{ FT}$

FROM A POTENTIAL RUPTURE
CHECK THE HORIZONTAL DISTANCE TRAVELED V IN 6 INCH INCREMENTS DOWNWARD FROM THE TOP OF THE TANK. INITIAL DOWNWARD VELOCITY IS ASSUMED AS ZERO FROM A HORIZONTAL RUPTURE.

- A.) AT 14 FT 0 INCH LEVEL, $h = 0$, $V_0 = 0$, MAXIMUM HORIZONTAL DISTANCE = 0

- B) AT 13 FT 6 INCH LEVEL, $h = .5$

$$\begin{aligned} V_0 &= \sqrt{2gh} \\ &= \sqrt{(2)(32.2)(.5)} \\ &= 5.67 \text{ FT/SEC} \end{aligned}$$

$$\begin{aligned} \text{Time REQUIRED TO FALL } y &= 13.5 \text{ FT} - 3.5 \text{ FT} = 10 \text{ FT} \\ y &= .5 g t^2 \\ 10 &= 16.1 t^2 \\ .788 \text{ sec} &= t \end{aligned}$$

$$\text{HORIZONTAL DISTANCE TRAVELED} = (.788 \text{ SEC})(5.67 \text{ FT/SEC}) = 4.47$$

EROSION CONTROLS

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SECTION 01565

EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 WORK SUMMARY

- A. Provide labor, material, and equipment necessary to complete the construction and maintenance of erosion control installations.
- B. Work described in this Section shall include but not be limited to the installation or construction of any of the following:
 - 1. Devices for Erosion and Sedimentation Control during Construction
 - a. Erosion bales
 - b. Geotextile silt fences
 - c. Inlet baskets
 - 2. Permanent Erosion Control Features
 - a. Erosion Mat

1.02 REFERENCE STANDARD

- A. Erosion controls during construction shall be installed and maintained as shown on the Erosion Control Plan and as prescribed in the Wisconsin DNR's Wisconsin Construction Site Best Management Practice Handbook, Publication No. WR-222-89.

PART 2 PRODUCTS

2.01 EROSION BALES

- A. Tightly compacted bales of grain straw, hay or other suitable material.

2.02 SILT FENCE

- A. Geotextile Fabric
 - 1. The textile shall be polyethylene fabric with properties as follows:

<u>Property</u>	<u>Minimum Requirements</u>
Filtering Efficiency	75 percent
Grab Strength	100 lbs.
Mullen Burst Strength	200 psi
Flow Rate	0.3 gal./sq.ft./min.
Ultra-Violet Stability	90 percent strength retained
Fabric Length	3.0 ft.

B. Geotextile Fencing

1. Geotextile fencing shall have a polypropylene or steel wire mesh netting secured to the textile to insure overall structural stability.

C. Support Posts

1. Wood or steel construction, minimum length 52 inches.
2. Supply staple, cord or other suitable means to attach geotextile to support posts.

2.03 INLET BASKETS

- A. Type M, as shown in the Erosion Control Plan.

2.04 EROSION MAT

- A. Erosion mat shall be S75, as manufactured by North American Green, Evansville, Indiana; or equal. The mat shall be insect, rodent, mildew, and rot resistant, and shall not be subject to damage or deterioration by sunlight.

PART 3 EXECUTION

3.01 GENERAL

- A. Requirements for implementation of Erosion and Sedimentation Control.
1. Keep disturbed areas as small as practical.
 2. Stabilize and/or protect disturbed areas as soon as possible.
 3. Install erosion and sedimentation control measures prior to construction, as shown on the Drawings.

4. Maintain all structures until construction is completed.
5. Repair, replace, and maintain all erosion and sedimentation structures until vegetation is re-established or permanent structures are installed.

3.02 EROSION BALES

- A. Place bales end to end across ditches or other locations designated on the Erosion Control Plan, or as required.
- B. Place bales at right angles to the direction of water flow.
- C. Embed and securely anchor bales with wood or steel stakes or posts.
- D. Excavate shallow sump on the upstream side of bales.

3.03 SILT FENCE

- A. Excavate shallow trench approximately 6 inches by 6 inches along perimeter of area to be fenced.
- B. Install geotextile in trench bottom to a depth of at least 6 inches.
- C. Install support post on downstream side of the geotextile to a depth that is adequate to insure stability of the geotextile fence.
- D. Secure wire or rope mesh and geotextile to posts using a suitable means.
- E. Backfill over geotextile in trench and compact.

3.04 INLET BASKETS

- A. Install inlet baskets in existing inlets, as shown on the Erosion Control Plan.
- B. Install inlet baskets in newly constructed inlets during the course of construction.

3.05 EROSION MAT

- A. Mat shall be placed in accordance with the manufacturer's written installation instructions, unless otherwise specified herein. The matting strips shall be rolled on or laid

parallel, at right angles to the direction of the slope. The mat shall be spread evenly, smoothly in a natural position without stretching and with all the parts bearing on the soil. Adjacent strips shall overlap at least 4 inches. Strip ends shall overlap at least 10 inches. All overlaps shall be made with the upgrade and upstream section on top.

- B. The lateral edge or end of each strip of mat adjoining pavement, manholes, or structures, and at the upgrade edge of the outside strip shall be buried at least 6 inches in a vertical slot cut in the soil and the soil pressed firmly against the embedded mat. The lateral edge or end of the mat shall extend at least 3 feet onto a flat area below a slope where none of the above surface features are encountered, and buried as specified above.
- C. The mat shall be anchored in place with vertically driven staples driven until their tops are flush with the soil. Erosion mat shall be stapled at a minimum of two staples per square yard except that additional staples shall be driven at 10-inch centers along embedded ends or edges. Staple gun and staples shall be furnished by the erosion mat manufacturer.

END OF SECTION

SECTION 02211

ROUGH GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Remove topsoil and stockpile for later reuse.
- B. Excavate subsoil and stockpile for later reuse.
- C. Grade and rough contour site.

1.02 TESTS

- A. Tests and analysis of fill materials will be performed in accordance with ANSI/ASTM D1557.

1.03 REFERENCES

- A. State of Wisconsin, Department of Transportation, Standard Specifications for Road and Bridge Construction, latest edition, including 1994 Supplemental Specifications, all lot grading, pavement subgrade, and all miscellaneous appurtenances, hereinafter to be referred to as the WisDOT-SSRBC.
- B. ANSI/ASTM C136 - Sieve Analysis of Fine and Coarse Aggregates
- C. ANSI-ASTM D1556 - Density of Soil in Place by the Sand-Cone Method.
- D. ANSI-ASTM D1557 - Moisture-Density Relations of Soils and Soil-Aggregate Mixture Using 10 lb. (4.54 kg) Rammer and 18-inch (457 mm) Drop.

1.04 PROTECTION

- A. Protection of trees, shrubs, lawns, rock outcropping, and other features remaining as portion of final landscaping.
 - 1. Prior to the commencement of the work, Contractor shall visit the site with Engineer to review the planned construction areas and to become familiar with requirements as to site and tree preservation; thereafter, the Contractor shall inform and instruct his personnel, suppliers, and subcontractors of such requirements.

2. Limit operations to those locations where site excavation and grading are planned.
 3. Avoid those areas designated to be maintained, as shown on Plans, in their existing state.
 4. Exercise extreme caution in working around or near areas containing trees, shrubs, etc., which are designated to be maintained.
 5. Do not cast excess (or other) material in such a manner so as to bury (or partially cover) tree trunks or shrubs (etc.) designated for preservation on the Project.
- B. Protect survey control points, bench marks, existing structures, fences, roads, paving, and curbs from equipment and vehicular traffic.
1. Contractor is solely responsible for the protection and/or replacement of all survey corners which exist throughout the area.
 2. Contractor shall be responsible for maintaining such items as and where they are required and for so long as they are required.
- Any costs incidental to this Section shall be borne by the Contractor.
- C. Protect above or below grade utilities which are to remain.
1. The Contractor shall protect, repair, and restore any underground drain lines, conduit, culverts, etc. encountered in the progress of the work and shall be responsible for the protection and replacing of any utilities encountered or damaged during construction, at no cost to the Owner.
- D. Protection of Additional Features to Remain.
1. Protect, repair, and replace any fences, signs, guard rails, or other structures damaged or displaced in the progress of the work, and the cost of this work shall be included in the bid price and no extra payment will be made therefore.

- E. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation. Remove shoring prior to backfilling. ,
- F. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe cases.
- G. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work in affected area.
- H. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.
- I. Grade excavation top perimeter to prevent surface water run-off into excavation.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code for disposal of debris.

1.06 PROJECT CONDITIONS

- A. Project Grading

Grading work covered in these specifications shall apply to all areas as specified and detailed on Drawings.

Work shall consist of clearing and grubbing, stripping and stockpiling vegetative material and topsoil, undercutting all unsuitable site materials, proof rolling undercut subgrade, excavating and compacting site, all in accordance with plans and specifications.

The Contractor shall reuse from the stockpiled topsoil sufficient quantities to spread 6 inches of topsoil on the cut slopes, ditches and landscaped areas of the proposed site, and remaining disturbed project areas outside of the site.

- B. Project Quantities

The overall project earth work has been computed using final grades as shown on the plans and is summarized as follows:

1. Stripped topsoil (estimated at 4-inch depth)		c.y.
2. Unclassified excavation to subgrade for all areas		
Raw Cut	=	c.y.
Sanitary, Storm Sewer and Water Trench Spoil		
Estimated	=	c.y.
Subtotal	=	c.y.
Shrinkage @ 20%	=	c.y.
Net Excavation Available	=	c.y.
3. Site Fill Required to Subgrade for all areas		
Raw Fill	=	c.y.
4. Excess Excavation	=	c.y.
5. Topsoil for Replacement @ 6-inch depth in all landscaped areas		
@ Topsoil Available on Site	=	c.y.
@ Topsoil Required on Site	=	c.y.
Excess Topsoil	=	c.y.

Quantities listed in specifications and plans are informational only. Contractor shall verify quantities and use his figures to bid this item. Total bid shall include excavation, placement of fill, grading, compaction, and all incidental costs associated with constructing this project.

C. Material Encountered

No variation from the price named in the proposal will be made or allowed whether the material through which excavations must be made are hard or soft, and wet or dry. Borings, if provided, were made at the approximate points indicated on the plans, with the log of such exploration data interpreted for the limits of the boring as shown. The explorations were made by ordinary and conventional methods and care deemed adequate for such purpose. However, since it is a matter of common knowledge that the exact character of any material and its reaction is difficult to determine from such subsurface

exploration and that the kind and character of material on the site may vary substantially from that indicated by the log. They are made available to the bidders simply for what they are worth, without any warranty, expressed or implied that the material to be encountered will conform therewith. If the log is used by the Contractor in making his bid, it is hereby expressly stipulated that the Owner accepts no responsibility for said use. A copy of the boring logs and report is available for inspection at the office of the Engineer. It is the Contractor's responsibility to determine for himself the character, nature, type, and condition of materials likely to be encountered in the proposed work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil: Salvaged excavated material, free of roots, rocks larger than 1 inch, subsoil, debris, and large weeds.

2.02 SELECT FILL MATERIALS

- A. "General fill" for filling and backfilling all areas outside of the building lines (except under paved areas) may be broken stone, sand, bank run gravel, earth, or approved material from excavation. All such fill shall be free from peat, wood, large stones or boulders, roots, cinders, trash, or other similar objectionable material with maximum size of lumps not more than 6 inches and rock maximum size of 3 inches.
- B. All other materials, not specifically described but required for proper completion of the work of this section, shall be subject to the approval of the Engineer.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify stockpiled fill to be reused if approved.
- B. Verify areas to be backfilled are free of debris and water.

3.02 CLEARING AND REMOVAL

- A. Clear areas required for access to site and execution of Work.

- B. Remove trees and shrubs within marked areas. Grub out stumps, roots, and surface rock.
- C. Clear undergrowth and deadwood, without disturbing subsoil.
- D. Upon completion of the work of this Section, immediately remove all debris from the site.

3.03 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Identify known below grade utilities. Stake and flag locations.
- C. Identify and flag above grade utilities.
- D. Maintain and protect existing utilities remaining which pass through work area.
- E. Notify utility company to locate utilities.
- F. Upon discovery of unknown utility, discontinue affected work; notify Owner.
- G. Cut out soft areas of subgrade which contain unsuitable soils for Project buildings, docks, and parking lots. Replace those areas with stable soils, compacted to a density so as to enable the sewers, water mains, street paving, and other installations and utilities to be constructed therein and thereon, without any later noticeable adverse after-effects.
- H. Any low bearing soils as removed shall be spread onto landscape areas as topsoil or fill material below the topsoil; in no case shall an amount of this material be so placed on any landscaped areas so as to, at a later date, require the building or utility contractors to experience extra costs for foundation or utility work.
- I. Provide berms or channels to prevent flooding of subgrade; promptly remove water collecting in depressions.
- J. When all areas to be paved have been excavated to proposed subgrade elevation, the area shall be proof-rolled with a fully loaded triaxial dump truck to detect any unstable areas that must be undercut.

- K. Subgrade preparation or re-shaping shall conform to the requirements of the applicable WisDOT-SSRBC Specifications.
- L. The compacted fill subgrade shall consist of and be (a) underlain by suitable bearing materials, (b) free of all organic, or other deleterious material, and (c) inspected and approved by the Engineer. Preparation of the subgrade after stripping organic and other unsuitable materials shall consist of (a) scarifying the top 6 to 8 inches, (b) proof-roll to detect soft, wet, yielding soils and other unstable materials that must be undercut, and (c) compacting the stripped and proof rolled surface to same minimum density as required for structurally compacted fill.
- M. For roadway support and building support in undercut and fill areas, the compacted fill must extend a minimum of 1-foot beyond the structure line and down to the compacted fill subgrade on a maximum 1 (horizontal): 2 (vertical) slope, or must be stepped or benched as required to flatten slope if not specifically approved by the Engineer.

3.04 EXCAVATION

- A. Remove lumped subsoil, boulders, rock, and bury on the site at locations approved by the Engineer.
- B. Correct unauthorized excavation at no cost to Owner.
- C. Stockpile excavated material on site in areas approved by the Engineer.
- D. The Contractor shall cut and/or fill, and shall thoroughly compact, as directed by the Engineer, the Project roadways, docks and parking areas prior to and sufficiently in advance of the work to be performed by the sewer and water main contractor, to within plus or minus 0.5' of the proposed subgrade. This grading will enable the sewer and water main contractor to install the underground utilities in the roads, docks, and parking lots and the laterals to the building line. The Contractor shall also grade any areas within the site where utilities are designed to be installed.
- E. Acceptable grade variations in non-paved areas shall be within plus or minus 0.20 foot of proposed grades (this acceptable variation shall not apply to the roadway, docks, or parking lots of the grading operations). At the request of the

Contractor, the Engineer may, in areas that he may deem as not critical to the accomplishment of the overall plan, vary the tolerances as herein stated.

- F. Excavation and filling shall be performed in a manner and sequence that will provide drainage at all times. Precipitation, springs, or seepage water encountered shall be pumped or drained to provide a suitable working platform.
- G. Remove all the excess trench spoil as set out by the sewer and water main contractor, and move and compact these soils to areas in the Project as directed by the Engineer, and as noted and required by the proposed grades on the plans for the Project.
- H. Contractor may not so direct the sewer and water main contractor to spoil the trench materials so as to result in high operational costs to that underground contractor, and in no case to do so to the added cost of the Owner.
- I. After the sewer and water main contractor has completed his excavations, re-grade the Project roadways to within plus or minus 0.10 foot of the proposed subgrade elevations in the roadway terrace areas and as indicated on the road plans for the Project and to final exact subgrade elevations (plus or minus 0.06 foot) in the Project roadways.
- J. After the Paving Contractor has completed the curb and gutter installation, backfill the curbs within three days. Following completion of the entire pavement, topsoil all terraces, landscape areas, and complete all restoration.

3.05 FILLING AND COMPACTION

- A. Structural Fill. The fill shall be placed in layers with a maximum loose thickness of 6 inches unless specifically approved by the Engineer considering the type of materials and compaction equipment being used. All project roadways and building pad areas shall require structural fill.
- B. Non-Structural Fill. Fill materials shall be placed in layers with a maximum loose thickness of 12 inches. Each layer shall be compacted to "Standard Compaction" as defined in the WisDOT-SSRBC.
- C. Non-Structural compacted fill adjacent to structural compacted fill shall be placed in unison to provide lateral support. Backfill adjacent to structures must be placed and compacted with care to ensure excessive unbalanced lateral pressures do not develop.

- D. The compaction equipment must be approved by the Engineer performing the inspection of fill placement and compaction to ensure that it is suitable for the type of materials being compacted. Under no circumstances may bulldozers or similar tracked vehicles be used for compaction equipment.

It is the responsibility of the Contractor to provide all necessary compaction equipment and other grading equipment that may be required to obtain the specified compaction.

- E. The compacted fill material shall be free of deleterious, organic or frozen matter, and shall have a maximum Liquid Limit (ASTM D-423 or AASHTO T-89) and Plastic Index (ASTM D-424 or AASHTO T-90) of 30 and 10, respectively, unless specifically tested and found to have low expansive properties. The top 12 inches of the compacted fill should have a maximum 3-inch particle diameter and all underlying compacted fill a maximum 6-inch diameter. All fill material must be approved by the Engineer prior to placement. If the fill is also to provide non-frost susceptible characteristics, it must be classified as a clean GW, GP, SW, or SP per Unified Soil Classification System (ASTM D-2487) or A-1 or A-3 per American Association of State Highway Officials Classification System.
- F. The density of the structural compacted fill shall not be less than 95 percent of the maximum dry density as determined by Modified Proctor (ASTM D-1557 or AASHTO D-2049); with the exception of the top 12 inches of the subgrade which shall have a minimum in-situ density of 95 and 100 percent of maximum dry density for cohesive and granular soils, respectively, or 5 percent higher than the underlying fill materials. The moisture content of cohesive fill shall not vary by more than -1 to +3 percent and granular fill -3 to +3 percent of optimum when placed and compacted.
- G. Any laboratory and field testing will be paid for by the Owner, but the Contractor shall extend full cooperation to the Engineer in obtaining soil samples for field and laboratory testing.

END OF SECTION

SECTION 02222

EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavation for slabs-on-grade and paving.
- B. Excavation for site structures.

1.02 FIELD MEASUREMENTS

- A. Verify that survey benchmark and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Identify known underground, above ground, and aerial utilities. Stake and flag locations.
- C. Notify utility company to remove and relocate utilities.
- D. Protect above and below grade utilities which are to remain.
- E. Protect plant life, rock outcropping and other features remaining as a portion of final landscaping.
- F. Protect bench marks, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

3.02 EXCAVATION

- A. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.
- B. Excavate subsoil required to accommodate slabs-on-grade, paving, and site structures.
- C. Machine slope banks to angle of repose or less, until shored.

- D. Excavation cut not to interfere with normal 45 degree bearing splay of foundation.
 - E. Grade top perimeter of excavation to prevent surface water from draining into excavation.
 - F. Hand trim excavation. Remove loose matter.
 - G. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume.
 - H. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
 - I. Correct unauthorized excavation at no extra cost to Owner.
 - J. Correct areas over-excavated by error.
 - K. Stockpile excavated material in area designated on site.
- 3.03 FIELD QUALITY CONTROL
- A. Field inspection will be performed under provisions of Division 1.
 - B. Provide for visual inspection of bearing surfaces.
- 3.04 PROTECTION
- A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
 - B. Protect bottom of excavations and soil adjacent to and beneath foundation, from freezing.

END OF SECTION

SECTION 02223

BACKFILLING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Site structure backfilling to subgrade elevations.
- B. Site filling and backfilling.
- C. Fill under slabs-on-grade and paving.
- D. Consolidation and compaction.
- E. Fill for over-excavation.

1.02 REFERENCES

- A. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ASTM D1241 - Specifications for Materials for Soil-Aggregates Subbase, Base, and Surface Courses.
- D. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 kg) Rammer and 18 inch (457 mm) Drop.

1.03 REGULATORY REQUIREMENTS

- A. Comply with local, State, and Federal regulations applicable to Work of this Section.
- B. Comply with OSHA Part 1926, Construction Health and Safety.

PART 2 PRODUCTS

2.01 BACKFILL MATERIALS

- A. Type A - Coarse Stone or Crushed Gravel: Angular, washed natural stone; free of shale, clay, friable material, sand, debris; graded in accordance with ANSI/ASTM D1241, Gradation C, within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
One inch	100
3/4 inch	85 to 100
5/8 inch	75 to 95
3/8 inch	55 to 85
No. 4	35 to 65
No. 10	25 to 50
No. 40	15 to 30
No. 200	5 to 15

- B. Type B - Site Excavated Material: Loam, clay, gravel, sands or mixtures, approved by Engineer, free of gravel or concrete fragments larger than 3 inches, bituminous paving materials, vegetable or organic matter, debris, refuse or frozen material.
- C. Type C - Aggregate Slurry: No. 1 and No. 2 coarse aggregate proportioned for Class 1 concrete with cement deleted, water added to provide 3-inch slump.
- D. Type D - Sand: Same as Type 4 bedding material specified under Section 02225.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify fill materials to be reused are acceptable.

3.02 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of insitu compaction. Backfill with Type A fill and compact to density equal to or greater than requirements for subsequent backfill material.
- C. Prior to placement of aggregate base course material at paved areas, compact subsoil to 95 percent of its maximum dry density in accordance with ANSI/ASTM D698.

3.03 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.

- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Granular Fill: Place and compact materials in continuous layers not exceeding 8 inches compacted depth.
- D. Soil Fill: Place and compact material in continuous layers not exceeding 8 inches compacted depth.
- E. Employ a placement method that does not disturb or damage foundation perimeter drainage, foundation dampproofing, foundation waterproofing, protective cover, and utilities in trenches.
- F. Maintain optimum moisture content of backfill materials to attain required compaction density.
- G. Backfill against supported site structure walls. Do not backfill against unsupported elements.
- H. Make grade changes gradual. Blend slope into level areas.
- I. Leave fill material stockpile areas completely free of excess fill materials.

3.04 MECHANICAL COMPACTION

- A. Backfill shall be mechanically compacted by means of tamping roller, sheepfoot roller, pneumatic tire roller, vibrating roller or other mechanical tampers. Impact, free-fall or "stomping" type compaction equipment shall not be used.
- B. Flooding or jetting of backfill for compaction purposes shall not be allowed.
- C. Contractor shall furnish written notification to Engineer prior to start of work as to size and type of mechanical compaction equipment to be used.
- D. The initial lift of material for mechanically compacted backfill shall be placed in a lift, which, prior to compaction shall not exceed thickness specified below for type of compaction equipment used:
 - 1. Vibratory equipment including vibratory plate, vibratory smooth-wheel rollers, and vibratory pneumatic-tired rollers; maximum lift thickness 2 feet.

2. Rolling equipment, including sheepsfoot (both vibratory and nonvibratory), grid, smooth-wheel (nonvibratory), pneumatic-tired (nonvibratory), and segmented wheels: maximum lift thickness 1 foot.

3.05 TOLERANCES

- A. Top Surface of Backfilling: Plus or minus 1 inch from required elevations.

3.06 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D698 and D1557 and with Division 1.
- C. Compaction testing will be performed in accordance with ANSI/ASTM D1557 modified proctor method, and with Division 1.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- E. Frequency of Tests: As determined by Engineer.

3.07 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Division 1.
- B. Recompact fills subjected to vehicular traffic.
- C. Plates shall be used to bridge open trenches crossing roadways and shall be secured against shifting or dropping into excavation.
- D. During winter months, plates shall not be left in roadway overnight.

3.08 SCHEDULE

- A. Underground Structures:
 1. Initial fill of Type A, 12 inches over top of structure, compacted to 95 percent,
 2. Remaining fill of Type B, to subgrade elevation, compacted to 95 percent.

- B. Exterior side of foundation walls
 - 1. Type B fill, to subgrade elevation, each lift, compacted to 90 percent modified proctor.
- C. Fill Under Grass Areas and Landscaped Area:
 - 1. Type B fill, to 6 inches below finish grade, compacted to 95 percent.
- D. Fill Under Proposed Asphaltic Concrete and Portland Cement concrete Paving:
 - 1. Type A Fill, to subgrade of proposed pavement section, compacted to 95 percent.
- E. Fill to Correct Over-excavation: Type D fill, flush to required elevation, compacted to 95 percent.
- F. Fill to Correct Over-excavation in Paving Areas:
 - 1. Type A fill, to finish subgrade, compacted to 95 percent.

END OF SECTION

SECTION 02225

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Trench excavation for utilities from 5 feet outside building to locations shown.
- B. Compacted bedding under fill over utilities.
- C. Compacted covering over utilities.
- D. Dewatering.

1.02 REFERENCES

- A. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 kg) Rammer and 18 inch (457 mm) Drop.

1.03 FIELD MEASUREMENTS

- A. Verify that survey benchmark and intended elevations for the Work are as shown on Drawings.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. Types A, B, C, and D, aggregate, subsoil, and slurry materials as specified in Section 02223 - Backfilling.

2.02 BEDDING AND COVERING MATERIALS

- A. Type 1 - For pipe 18 inch diameter or less: Crushed chips made from crushing sound limestone, dolomite ledge rock or rock material of regional significance; natural stone; free of shale, clay, friable material, sand, debris; graded within following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
1/2 inch	100%
3/8 inch	90 to 100%
No. 8	0 to 15%
No. 30	0 to 3%

- B. Type 2 - For pipe 18 inch diameter or larger, of same material as Type 1, but graded within following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
1 inch	100%
3/4 inch	90 to 100%
3/8 inch	20 to 55%
No. 4	0 to 10%
No. 8	0 to 5%

- C. Type 3 - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded in accordance with ASTM C136, to following:

1. Minimum Size: 1/4 inch
2. Maximum Size: 5/8 inch

- D. Type 4 - Bedding Sand: Natural river or bank sand; free of silt, clay, or loam, friable or soluble materials, or organic matter; consisting of durable particles ranging in size from fine to coarse in uniform combinations; maximum moisture content shall be 10%, graded within following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8 inch	100%
No. 4	95 to 100%
No. 8	75 to 90%
No. 16	55 to 75%
No. 30	30 to 50%
No. 50	10 to 25%
No. 100	2 to 10%
No. 200	0 to 5%

2.03 EQUIPMENT

- A. Contractor shall utilize equipment specifically applicable to dewatering work.
- B. Equipment shall be operated and maintained in an efficient manner to produce acceptable results.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify fill materials to be reused, is acceptable.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Maintain and protect existing utilities remaining, which pass through work area.
- C. Protect plant life, lawns, rock outcropping, and other features remaining as a portion of final landscaping.
- D. Protect bench marks, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.
- E. Protect above and below grade utilities which are to remain.
- F. Cut out soft areas of subgrade not capable of insitu compaction. Backfill with Type A fill specified under Section 02223 and compact to density equal to or greater than requirements for subsequent backfill material.

3.03 REMOVAL AND DISPOSAL OF WATER

- A. Provide equipment and methods to remove water entering excavations, trenches, and other parts of the Work.
- B. Maintain excavations and trenches relatively dry until construction is completed.
- C. No concrete or masonry shall be placed in water nor shall water be allowed to rise above concrete or masonry for a minimum of 24 hours.
- D. Water level shall be maintained at an elevation to prevent the flotation of the installed Work until backfilling or other means are employed to prevent any flotation.
- E. Use of a well point system shall be submitted to Engineer for review and comment prior to its use.
- F. Contractor shall dispose of water from Work.
- G. Unless prior approval is obtained, no ground or surface water shall be discharged to a sanitary sewer.

- H. Water may be allowed to drain through completed storm sewer work after concrete units have set up sufficiently to prevent damage.
- I. Piping and manholes used for dewatering shall be completely cleaned of all debris and foreign material upon completion of dewatering and prior to use for which it was intended.

3.04 EXCAVATION

- A. Excavate subsoil required for utility piping as shown on Drawings.
- B. Excavation shall not interfere with normal 45 degree bearing splay of foundations.
- C. Cut trenches to a maximum width at top of pipe to outside diameter of pipe plus 24 inches to enable installation of sanitary sewer, storm sewer, and water main, and to allow inspection.
- D. Width at top of pipe may be increased with prior approval. Engineer to allow for stringers and sheathing when required.
- E. Pipe to be laid in open-cut trench shall have 6-inch minimum clearance between outside face of pipe barrel and face of sheathing or side wall of trench.
- F. Maximum width of trench at surface of ground shall not exceed width of trench at top of pipe by more than 2 feet without permission of Engineer, unless it is specifically allowed on construction drawings.
- G. Excavated material shall be stockpiled in spoil area designated by Construction Manager.
- H. Contractor shall keep all finished excavations free of water or sewage during work.
- I. After delivery to designated location, such material shall be stockpiled within staked limits by Contractor.
- J. No more trench shall be excavated in advance of completed pipe laying operations than can be completed and backfilled by end of work day.
- K. Hand trim excavation. Remove loose matter.

- L. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd, measured by volume. Larger material will be removed under Section 02222.
- M. Correct unauthorized excavation at no cost to Owner.
- N. Correct areas over-excavated by error in accordance with Section 02222.
- O. Stockpile excavated material in area designated on site.

3.05 BEDDING AND COVERING

- A. Support pipe during placement and compaction of bedding fill.
- B. Trench bottom shall be free of water prior to placement of bedding and laying of pipe.
- C. Place and shape to pipe, bedding material to a minimum depth of 3 inches under bell and 4 inches under spigot.
- D. Bring bedding/cover material over top of pipe to a minimum compacted depth as indicated on drawings.
- E. Where sand is used for cover material, it shall be compacted with a portable plate compactor to a depth of 12 inches in two lifts of 6 inches.

3.06 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Backfill trench as provided under Section 02223 - Backfilling.
- D. Employ a placement method that does not disturb or damage foundation perimeter drainage, conduits in trench, and other installed elements.
- E. Maintain optimum moisture content of backfill materials to attain required compaction density.
- F. Leave fill material stockpile areas completely free of excess fill materials.

3.07 TOLERANCES

- A. Top Surface of Backfilling: Plus or minus 1 inch from required elevations.

3.08 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D698 and D1557 and with Division 1.
- C. Compaction testing will be performed in accordance with ANSI/ASTM D1557 modified proctor method.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- E. Frequency of Tests: As determined by Engineer.

3.09 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Division 1.
- B. Recompact fills subjected to vehicular traffic.
- C. Plates shall be used to bridge open trenches crossing roadways and shall be secured against shifting or dropping into trenches.

END OF SECTION

SECTION 02231

AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course.

1.02 REFERENCES

- A. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 inch Drop.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Controlled Fill: Granular material; crushed gravel, washed natural stone; free of shale, clay, friable material, sand, and debris; graded in accordance with ASTM C136 within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
2 inches	100
1 inch	95 to 100
3/4 inch	95 to 100
5/8 inch	75 to 100
3/8 inch	55 to 85
No. 4	35 to 60
No. 16	15 to 35
No. 40	10 to 25
No. 200	5 to 10

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

3.03 AGGREGATE PLACEMENT

- A. Spread aggregate over prepared substrate to a total compacted thickness as indicated in Schedule.
- B. Place aggregate in maximum 6 inch layers and roller compact to specified density.
- C. Level and contour surfaces to elevations and gradients indicated.
- D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/2 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation From Design Elevation: Within 1/2 inch.

3.05 FIELD QUALITY CONTROL

- A. Division 1 - Quality Assurance: Field inspection.
- B. Compaction testing will be performed in accordance with ASTM D1557 modified proctor method.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- D. Frequency of Tests: As determined by Engineer.

3.06 SCHEDULES

A. Under Asphalt Pavement:

1. Compact placed aggregate materials to achieve compacted thickness, 9-inch at compaction of 100 percent for access roadway and parking lot.

B. Under Concrete Pavement:

1. Compact placed aggregate materials to achieve 6-inch compacted thickness at compaction of 100 percent.

END OF SECTION

SECTION 02510

ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Asphaltic concrete paving; surface, binder or base course.
- B. Pavement markings on asphaltic and Portland Cement concrete paving.

1.02 REFERENCES

- A. State of Wisconsin, Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, including the 1994 Supplemental Specifications; hereinafter referred to as the WisDOT SSRBC Specifications.
- B. MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types - The Asphalt Institute (AI).
- C. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI).
- D. MS-4 - The Asphalt Handbook - The Asphalt Institute (AI).
- E. MS-8 - Asphalt Paving Manual - The Asphalt Institute (AI).
- F. MS-19 - Basic Asphalt Emulsion Manual, The Asphalt Institute (AI).
- G. ASTM D946 - Penetration-Graded Asphalt Cement for Use in Pavement Construction.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with AI Manual MS-8.
- B. Mixing Plant: Conform to AI Manual MS-3.
- C. Obtain materials from same source throughout.
- D. Maintain one copy of each document on site.

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable code for paving work on public property.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Asphalt Cement: ASTM D946, with a penetration grade of 85-100.
- B. Aggregate for Binder Course Mix: In accordance with WisDOT-SSRBC Specifications and shall be in general conformance with the following gradation:

PERCENTAGE BY WEIGHT PASSING

<u>Sieve Size</u>	<u>Gradation</u>
1-1/2 inch	100
1 inch	95 - 100
3/4 inch	80 - 95
1/2 inch	65 - 85
3/8 inch	50 - 75
No. 4	35 - 60
No. 8	20 - 45
No. 50	7 - 20
No. 200	3 - 10

- C. Aggregate for Surface Course Mix: In accordance with WisDOT-SSRBC Specifications and shall be in general conformance with the following gradation:

PERCENTAGE BY WEIGHT PASSING

<u>Sieve Size</u>	<u>Gradation</u>
3/4 inch	100
1/2 inch	90 - 97
3/8 inch	75 - 95
No. 4	45 - 75
No. 8	30 - 55
No. 30	15 - 35
No. 50	10 - 25
No. 200	5 - 10

- D. Fine Aggregate: Sand In accordance with WisDOT-SSRBC Specifications.

- E. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.

2.02 ACCESSORIES

- A. Primer: Homogeneous, medium curing, liquid asphalt.
- B. Tack Coat: Homogeneous, medium curing, emulsified asphalt.

2.03 ASPHALT PAVING MIX

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Binder Course: 4.5 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.
- C. Wearing Course: 5 to 7 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

2.04 SOURCE QUALITY CONTROL

- A. Provide mix design for asphalt under provisions of Division 1.
- B. Submit proposed mix design of each class of mix for review prior to commencement of work.
- C. Test samples in accordance with AI MS-2.

2.05 PAVING MARKINGS

- A. FS TT-P-85 and TT-P-115 Type I, alkyd, color white. Sherwin Williams - B29W, Pratt & Lambert Traffic Paint, or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify base conditions under provisions of Division 1.
- B. Verify that compacted granular base is dry and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.

3.02 SUBBASE

- A. Section 02231 - Aggregate Base Course forms the base construction for work of this Section.

3.03 PREPARATION - PRIMER

- A. Apply primer in accordance with AI MS-2.
- B. Apply primer to contact surfaces of curbs and gutters.
- C. Use clean sand to blot excess primer.

3.04 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with MS-19.
- B. Apply tack coat to contact surfaces of curbs and gutters.
- C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.05 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place asphalt binder course within 24 hours of applying primer or tack coat.
- B. Place binder course to thickness identified in schedule at end of Section.
- C. Place surface course within two hours of placing and compacting binder course.
- D. Place surface course to thickness identified in schedule at end of Section.
- E. Adjust manhole frames, in correct position and elevation.
- F. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- G. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.06 PAVEMENT MARKINGS

- A. Follow manufacturer's instructions for preparation and application.
- B. Apply markings as shown on Drawings.

3.07 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation from True Elevation: Within 1/2 inch.

3.08 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Take samples and perform tests in accordance with AI MS-2.

3.09 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury until ready for use.

3.10 SCHEDULES

- A. Pavement at front of mixing building and auto Parking Lot: 2 courses; binder course of 2-1/2-inch compacted thickness, surface course of 1-1/2-inch compacted thickness.
- B. Pavement at all other areas: 3 courses; 2 binder courses of 2-inch and 1-1/2-inch compacted thickness; surface course of 1-1/2-inch compacted thickness.

END OF SECTION

SECTION 02520

PORTLAND CEMENT CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete sidewalks, integral curbs, gutters, roll-off pads, and loading docks.

1.02 REFERENCES

- A. State of Wisconsin, Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, including the 1994 Supplemental Specifications; hereinafter referred to as the WisDOT SSRBC Specifications.
- B. ACI 301 - Specifications for Structural Concrete for Buildings.
- C. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- D. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- E. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
- F. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
- G. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- H. ASTM C33 - Concrete Aggregates.
- I. ASTM C94 - Ready Mix Concrete.
- J. ASTM C150 - Portland Cement
- K. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.

- B. Product Data: Provide data on admixtures and curing compounds.

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301.
- B. Obtain cementitious materials from same source throughout.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable standards for paving work on public property.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Form Materials: Conform to ACI 301.
- B. Steel form material, profiled to suit conditions.
- C. Joint Filler: ANSI/ASTM D1751 type; 1/2, 3/4, and 1-inch thick.

2.02 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615; 40 ksi yield grade; deformed billet steel bars; epoxy coated finish.
- B. Welded Steel Wire Fabric: Plain type, ANSI/ASTM A185; in flat sheets or coiled rolls; epoxy coated finish.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150 Normal - Type I Portland type, gray color.
- B. Fine and Coarse Mix Aggregates: ASTM C33.
- C. Water: Potable, not detrimental to concrete.
- D. Chemical Admixture: By prior approval of Engineer only.

2.04 ACCESSORIES

- A. Curing Compound: ASTM C309, Type 1, Class A; or wet burlap.

2.05 CONCRETE MIX

- A. Mix and deliver concrete in accordance with ASTM C94.
- B. Provide concrete to the following criteria:
 - 1. Compressive Strength: 2,500 psi @ 7 days.
 - 2. Compressive Strength: 4,000 psi @ 28 days.
 - 3. Slump: 1 to 3 inches.
 - 4. Air Entrained: 6 percent.
- C. Use accelerating admixtures in cold weather only when approved by Engineer. Use of admixtures will not relax cold weather placement requirements.
- D. Use calcium chloride only when approved by Engineer.
- E. Use set retarding admixtures during hot weather only when approved by Engineer.

2.06 SOURCE QUALITY CONTROL

- A. Provide mix design under provisions of Division 1.
- B. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of work.
- C. Test samples in accordance with ACI 301.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify base conditions under provisions of Division 1.
- B. Verify compacted granular base is acceptable and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.

3.02 SUBBASE

- A. Section 02231 - Aggregate Base Course forms the base construction for work of this Section.

3.03 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement.

3.04 FORMING

- A. Place and secure forms to correct location, dimension, and profile.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

- A. Place reinforcement at mid-height of slabs-on-grade.
- B. Interrupt reinforcement at expansion joints.

3.06 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301.
- B. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
- C. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- D. Place concrete to pattern indicated.

3.07 JOINTS

- A. Place expansion joints at maximum 100 foot intervals in sidewalks, at maximum 300 foot intervals in curb and gutter, and at all change of directions. Align curb, gutter, and sidewalk joints.

- B. Place joint filler between paving components and building or other appurtenances.
- C. Provide sawn joint intervals in sidewalk at 5-foot intervals as shown on the construction plans; in curb and gutter at 10-foot intervals adjacent to asphalt pavement, and at intervals which match the joint spacing in adjacent concrete pavement.
- D. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab or sidewalk.

3.08 FINISHING

- A. Area Paving: Broom with sawn or trowel joint edges.
- B. Sidewalk Paving: Light broom and trowel joint edges.
- C. Curbs and Gutters: Broom with sawn or trowel joint edges.
- D. Inclined Ramps: Broom perpendicular to slope.
- E. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.09 PAVEMENT MARKINGS

- A. As specified under Section 02510.

3.10 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Testing firm will take cylinders and perform slump tests in accordance with ACI 301.
- C. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.
- D. One slump test and one entrained air test will be taken for each set of test cylinders taken.
- E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.11 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

3.12 SCHEDULES

- A. Sidewalks: 3500 psi at 28 days, concrete 5 inches minimum thickness; gray color, broom finish.
- B. Curb & Gutter and Driveway Paving: 4000 psi at 28 days, concrete 8 inches minimum thickness, or as detailed for curb and gutter; gray color, broom finish.

END OF SECTION

SECTION 02607

MANHOLES AND COVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Precast concrete manholes with transition to lid frame, covers, anchorage and accessories.

1.02 REFERENCES

- A. City of Milwaukee, Sewer and Building Service Specifications, January 1, 1983, hereinafter referred to as the City Sewer Specifications.
- B. ASTM A48 - Gray Iron Castings.
- C. ASTM 318 - Building Code Requirements for Reinforced Concrete.
- D. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- E. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: Indicate manholes locations, elevations, piping, sizes and elevations of penetrations, ladder rungs, and reinforcing.
- C. Product Data: Provide manhole covers, component construction, features, configuration, dimensions.
- D. Submit structural design calculations and detailed drawings for flat top and special precast structures prepared and sealed by a Professional Engineer registered in the State of Wisconsin.
- E. Design of flat top and special precast structures shall be in accordance with ACI 318 and ASTM C478.
- F. Submit concrete mix design and test reports from an approved testing laboratory certifying that concrete used in precast structures conforms with requirements specified.

1.04 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Precast Concrete Riser and Eccentric Cone section: In accordance with ASTM C478; minimum wall thickness, 4-1/2 inches for 42-inch diameter riser, 5 inches for 48-inch diameter riser, and 6 inches for 60-inch diameter riser.
- B. Precast Concrete Base Riser Section with Integral Floor: In accordance with ASTM C478, minimum thickness 6 inches; cast in place pipe sleeves.
- C. Minimum access opening in cone or top section: 26-inch diameter.
- D. Minimum compressive strength of concrete: 4000 psi.
- E. Section shall support own weight and a live load equivalent to AASHTO HS-20 Highway Loading unless otherwise indicated on Drawings.
- F. Exterior wall shall be designed for a minimum equivalent fluid pressure of 90 pounds per square foot and consideration shall be given to additional lateral pressure from approaching truck wheels.
- G. Form and cast openings with wall sleeves in base sections as required by Drawings.
- H. Horizontal wall joints shall not be located within 18 inches of centerline of wall penetration.
- I. Section joints: Tongue and groove.
- J. Identification Markings: Clearly marked on inside of each precast section indicating date of manufacture, name or trademark of manufacturer. Clearly mark on outside of each section, vault identification number from Drawings.

K. Sanitary Manhole Internal Frame/Chimney Seal

1. The flexible rubber sleeve shall be extruded from a high grade rubber compound conforming to the applicable requirements of ASTM C-923, with a hardness (durometer) of 45 plus or minus 5. The sleeve shall be double-pleated with a minimum unexpanded vertical height of 8 inches, a minimum thickness of 3/16 inches, and shall be capable of vertical expansion, when installed, of not less than 2 inches. The top and bottom section of the sleeve shall contain an integrally formed expansion band recess and multiple sealing fins. Any splice used to fabricate the sleeve shall be hot-vulcanized and have a strength such that the sleeve shall withstand a 180-degree bend with no visible separation.
2. The expansion bands used to compress the sleeve against the manhole shall be 16 gauge stainless steel conforming to ASTM A-240, Type 304, with a minimum width of 1-3/4 inches. The expansion mechanism shall have the capacity to develop the pressures necessary to make a watertight seal and shall have a minimum adjustment range of 2 diameter inches. Studs and nuts used for this mechanism shall be stainless steel, conforming to ASTM F-593 and 594, Type 304.
3. The internal rubber seal shall be manufactured by Cretex Specialty Products, or approved equal.

2.02 COMPONENTS

- A. Manhole Lid and Frame: ASTM A48, Class 35B Cast iron construction; lid molded with identifying system type; Neenah Foundry Co., R-1661 self-sealing with dovetail gasket, machined bearing surfaces and concealed pick holes and no vent holes.
- B. Manhole Steps: Manhole steps shall be Type PS1-PF as manufactured by M.A. Industries, Peachtree City, GA 30269; or equal. Provide certified test data that the steps are capable of withstanding an 800-pound vertical load without sustaining more than a 3/8-inch permanent set when tested in accordance with Section 10 of ASTM C497.
- C. Catchbasin Frames and Grates: ASTM A48, Class 35B Cast Iron Construction. Catchbasins shall be Neenah Foundry Co., No. R-3210, or equal.

2.03 PIPE AND JOINT SEALANTS AND GASKETS

- A. Pipe Sleeve-Factory Cast In Place: "Lock Joint Flexible Manhole Sleeve"; "KOR-N-SEAL"; or an approved equal, cast in precast base section.
- B. Pipe Sleeve-Field Installed: "KOR-N-SEAL" when approved by Architect/Engineer.
- C. Tongue and Groove Preformed Joint Sealant: Preformed flexible joint sealant, Kent Seal No. 2 as manufactured by Hamilton-Kent; Ram-Nek as manufactured by K. T. Snyder Co.; or an approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 PLACING MANHOLE SECTIONS

- A. Excavation of manhole structure area shall be in accordance with Section 02225 and to depth required on Drawings.
- B. Horizontal excavation shall be limited to outside diameter of manhole structure plus sufficient exterior clearance to allow a safe work area for installers.
- C. Excavated depth shall provide for a minimum 6 inches of compacted Type 2 bedding as specified under Section 02225 under manhole base.
- D. Where ground water is present in bottom of manhole excavation, remove water by pumping, maintain free of water, place minimum 12 inches of No. 2 crushed stone as bedding for manhole base.

- E. Set base section, align pipe sleeve openings to provide straight alignment of pipe through manhole base, level and plumb section.
- F. Manhole shall be set at a grade to assure that no more than 8 inches of precast concrete rings would be required to bring manhole frame and cover to final grade.
- G. Place preformed flexible joint sealant on either side of tongue portion of joint in base section to assure filling of entire joint when assembled.
- H. Set riser section on base, aligning joint prior to setting, lower riser section level and uniformly on to base to squeeze joint compound throughout tongue and groove joint, visible for inspection both interior and exterior for water-tight fit. Trowel excess material flush at interior and exterior surface after placement.
- I. Repeat process for remaining riser sections and top, exercising care to align ladder rungs to form uniform vertical ladder.
- J. Sections shall be vertical and in true alignment with a maximum 1/4 inch tolerance per section allowed.
- K. Joints shall be allowed to set for a minimum 24 hour period before backfilling.
- L. Holes in sections required for handling or other purposes shall be plugged with a non-shrinking grout, finished flush on inside.
- M. Backfilling shall be performed carefully, bringing fill up evenly on all sides.
- N. Compaction of fill around vault shall be accomplished with a mechanical hand operated wacker.
- O. DAMPPROOFING
 - A. Apply two coats of bituminous dampproofing to outer surfaces of manhole structure prior to backfilling at a rate of 40 square feet per gallon in accordance with manufacturer's instructions.
 - B. Dampproofing shall be Sonneborn Building Products "Hydrocide 648"; A.C. Horn Inc. "Dehydratine 4"; or an approved equal.

3.04 VACUUM TESTING OF MANHOLES

- A. Sanitary sewer manholes shall be tested for leakage immediately after installation and prior to backfilling.
- B. Engineer shall witness testing. Tests conducted without Engineer will be nullified and a retest will be required.
- C. Lift holes shall be plugged with a non-shrink grout.
- D. Inlet and outlet pipes at manhole shall be plugged, taking care to securely brace plug to avoid its being drawn into manhole.
- E. Vacuum test equipment shall be placed inside of top of cone section and seal inflated to 40 psi to effect a seal between vacuum base and structure.
- F. A vacuum of 10 inches of mercury shall be drawn and vacuum pump shut-off.
- G. With valves closed, time shall be measured for vacuum to drop to 9 inches.
- H. Manhole integrity is acceptable if the time exceeds 60 seconds for a 48-inch diameter manhole.
- I. If manhole fails initial test, necessary repairs shall be made with a non-shrink grout or other acceptable and approved materials.
- J. Retesting shall proceed until a satisfactory test is obtained.
- K. Contractor shall repair all visible defective joints or leaks in manhole even though vacuum test requirements are met.
- L. Cost of equipment purchase or lease, materials, and labor necessary to conduct vacuum testing of manholes is incidental to and shall be included in cost bid for sanitary manhole construction

END OF SECTION

SECTION 02667

SITE WATER LINES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe and fittings for site water line including domestic water line, fire water line.
- B. Valves and fittings.

1.02 REFERENCES

- A. City of Milwaukee Water Main Installation Specifications, January 2, 1987, hereinafter referred to as the City Water Specifications.
- B. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
- C. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other liquids.
- D. ANSI/AWWA C111- Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.
- E. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- F. ANSI/AWWA C500 - Gate Valves, 3 through 48 in NPS, for Water and Sewage Systems.
- G. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.
- H. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Accurately record actual locations of piping mains, valves, connections, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with Local Plumbing Code.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 1.
- B. Deliver and store valves in shipping containers with labelling in place.

PART 2 PRODUCTS

2.01 MANUFACTURERS - WATER PIPE

- A. U.S. Pipe, Tyton Joint, Class 52.
- B. Griffin Pipe, Tyton Joint, Class 52.
- C. (Clow) McWane, Inc., Tyton Joint, Class 52.
- D. Substitutions: As provided by Engineer.

2.02 PIPE

- A. Ductile Iron Pipe: ANSI/AWWA C151:
 - 1. Fittings: Ductile iron, standard thickness.
 - 2. Joints: ANSI/AWWA C111; Bell and spigot ends for rubber gasket push-on joints.
 - 3. Pipe shall have cement mortar lining with internal and external bituminous coating.

4. Jackets: ASTM D-1248 polyethylene jacket with 0.010 inch polyethylene adhesive tape.
- 2.03 GATE VALVES - 3 Inches (75 mm) and Over
- A. Manufacturers:
 1. Mueller Super Seal, Model: Resilient Seat Gate Valve.
 2. Kennedy, Model: Kew-Seal II.
 3. American Flow Control, Resilient Wedge Valve Model: Series 500.
 4. (McWane, Inc.) Cloy R/W, Resilient Wedge Valve.
 5. or approved equal.
 - B. Gate Valve Features: AWWA-C509; non-rising bronze stem, 200 psi working pressure; internal parts accessible without removing main body from pressure line; internal cast iron surfaces to be coated with two (2) coats of corrosion resistant coating; internal diameter of valve equal to or greater than connection pipe diameter; valve opens counter-clockwise; flanged ends, mechanical joint or slip joint ends as designated; furnished with 2 inch operating nut.
 - C. ANSI/AWWA C509, Iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged mechanical joint ends, control rod, post indicator, extension box and valve key.

2.04 BEDDING AND COVERING MATERIALS

- A. Bedding: Fill Type 4 as specified in Section 02225.
- B. Covering: Fill Type 4 as specified in Section 02225.

2.05 ACCESSORIES

- A. Concrete for Thrust Blocks as specified in City Water Specifications.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions under provisions of Division 1.

- B. Verify that building service connection and municipal utility water main size, location and invert are as indicated.

3.02 PREPARATION

- A. Ream pipe and tube ends and remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.03 BEDDING

- A. Excavate pipe trench in accordance with Section 02225 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level fill materials in one continuous layer as specified under Section 02225.
- C. Backfill in accordance with Section 02223 around sides and to top of pipe with fill, tamped in place and compacted to 95 percent.
- D. Maintain optimum moisture content of bedding material to attain required compaction density.

3.04 INSTALLATION - PIPE

- A. Maintain separation of water main from sewer piping as shown on Drawings.
- B. Install pipe to indicated elevation to within tolerance of 5/8 inches.
- C. Install ductile iron piping and fittings to ANSI/AWWA C600.
- D. Route pipe in straight line.
- E. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- F. Install access fittings to permit disinfection of water system performed under Section 02675.

- G. Slope water pipe and position drain at low points.
 - H. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main.
 - I. Establish elevations of buried piping to ensure not less than 3.0 ft. of cover.
 - J. Backfill trench in accordance with Section 02225.
- 3.05 INSTALLATION - VALVES
- A. Set valves on solid bearing using maple heart wood blocking or concrete blocking.
 - B. Center and plumb valve box over valve. Set box cover flush with finished grade.
- 3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM
- A. Flush and disinfect system in accordance with Section 02675.
- 3.07 SERVICE CONNECTIONS
- A. Provide water service to utility company requirements.
 - B. Provide sleeve in cast-in-place concrete meter vault wall for service main. Support with reinforced concrete bridge. Caulk sleeve watertight.
- 3.08 FIELD QUALITY CONTROL
- A. Field inspection and testing will be performed under provisions of Division 1.
 - B. Compaction testing will be performed in accordance with Sections 02223 and 02225.
 - C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

END OF SECTION

SECTION 02675

WATER MAIN DISINFECTION

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This Section covers the materials and techniques used in the disinfection of the water main as shown on the Drawings. This Section is a supplement to the City of Milwaukee Water Main Installation Specifications - 1987. In case of conflict, this Section of the Specifications shall govern.
- B. Disinfection of potable water distribution and transmission system.
- C. Testing and reporting results.

1.02 REFERENCES

- A. City of Milwaukee Water Main Installation Specifications, January 2, 1987; hereinafter referred to as the "City Water Specifications."
- B. ANSI/AWWA B300 - Standard for Hypochlorites.
- C. ANSI/AWWA C651 - Standards for Disinfecting Water Mains.

1.03 SUBMITTALS

- A. Test Reports: Provide as required in Chapter 5.18.0 of the City Water Specifications.
- B. Certificate: Certify that cleanliness of water distribution system meets or exceeds City Water Specification requirements.

1.04 PROJECT RECORD DOCUMENTS

- A. Disinfection Report; record:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.
 - 3. Test locations.

4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
5. Date and time of flushing start and completion.
6. Disinfectant residual after flushing in ppm for each outlet tested.

B. Bacteriological Report; record:

1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.
5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certification that water conforms, or fails to conform, to bacterial standards of City of Milwaukee.
8. Bacteriologist's signature and authority.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with ANSI/AWWA C651.

1.06 REGULATORY REQUIREMENTS

- A. Conform to City Water Specification for performing the Work of this Section.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of water system.

PART 2 PRODUCTS

2.01 DISINFECTION CHEMICALS

- A. Chemicals: ANSI/AWWA B300, Hypochlorite, to be supplied and placed by the Contractor.

2.02 FLUSHING WATER

- A. Use municipal water source.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping system has been cleaned, inspected, and pressure tested.
- B. Perform scheduling and disinfection activity with startup, testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.02 EXECUTION

- A. Provide and attach required equipment to perform the Work of this Section.
- B. Introduce treatment into piping system.
- C. Maintain disinfectant in system for 24 hours.
- D. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.
- E. Replace permanent system devices removed for disinfection.
- F. Pressure test system to 150 psi. Repair leaks and re-test.

3.03 QUALITY CONTROL

- A. Test samples in accordance with ANSI/AWWA C651.

END OF SECTION

SECTION 02722

SITE STORM SEWER

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Site storm sewerage drainage piping, fittings and accessories, and bedding.
- B. Connection of building storm water drainage system to municipal sewers.
- C. Inlets and site discharge appurtenances.

1.02 REFERENCES

- A. City of Milwaukee, Sewer and Building Service Specifications, January 1, 1983, hereinafter referred to as the City Sewer Specifications.
- B. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- C. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide data indicating pipe and pipe accessories.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 REGULATORY REQUIREMENTS

- A. Conform to City Sewer Specifications for materials and installation of the Work of this section.

1.06 FIELD MEASUREMENTS

- A. Verify that field measurements and elevations are as indicated.

1.07 COORDINATION

- A. Coordinate work under provisions of Division 1.
- B. Coordinate the Work with termination of storm sewer connection outside building and trenching.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Reinforced Concrete Pipe: ANSI/ASTM C76, Class IV and V with Wall Type B; mesh reinforcement; inside nominal diameter indicated on drawings; bell and spigot end joints.
- B. Reinforced Concrete Pipe Joint Device: ANSI/ASTM C443, rubber compression gasket joint.

2.02 PIPE ACCESSORIES

- A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.03 CATCHBASINS AND MANHOLES

- A. Catchbasin and Manhole Lid and Frame: As specified in Section 02607.
- B. Catchbasins shall be constructed of 8-inch solid concrete on 5-inch precast concrete to meet the requirements of the detailed drawings located on the Construction Plans.
- C. Standard Manholes
 - 1. All standard manholes and inlet manholes shall be precast manholes with corbel section except that flat top slabs may be used on all structures rather than a corbel section if the depth of said structure will not allow a corbel section.
 - 2. All precast manhole sections shall have gasketed joints.

2.04 BEDDING MATERIALS

- A. Bedding: Fill Type 1 and 2 as specified in Section 02225.
- B. Covering: Fill Type 1 and 2 as specified in Section 02225.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.02 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with course aggregate.
- B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.03 BEDDING

- A. Excavate pipe trench in accordance with Section 02225 for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, as specified under Section 02225.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.04 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal joints watertight.
- B. Place pipe bedding in accordance with Section 02225.
- C. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8-inch in 10 feet.
- D. Place covering in accordance with Section 02225.
- E. Refer to Section 02225 for trenching requirements. Do not displace or damage pipe when compacting.

F. Refer to Section 02607 for manhole requirements.

G. Connect to building sewer outlet, municipal storm sewer system, manholes.

3.05 INSTALLATION - CATCHBASINS AND MANHOLES

A. Conform to Section 02607.

3.06 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 1.

B. Request inspection prior to and immediately after placing aggregate cover over pipe.

C. Compaction testing will be performed in accordance with Sections 02223 and 02225.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.07 PROTECTION

A. Protect finished Work under provisions of Division 1.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 02732

SITE SANITARY SEWER

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary sewerage drainage piping, fittings, accessories and bedding.
- B. Connection of building sanitary drainage system to municipal sewers.

1.02 REFERENCES

- A. City of Milwaukee, Sewer and Building Service Specifications, January 1, 1983, hereinafter referred to as the City Sewer Specifications.
- B. ANSI/ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- C. ANSI/ASTM D3034 - Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
- D. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide data indicating pipe and pipe accessories.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Division 1.
- B. Record location of pipe runs, connections, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code for installation of the Work of this section.

1.06 FIELD MEASUREMENTS

- A. Verify that field measurements and elevations are as indicated.

1.07 COORDINATION

- A. Coordinate work under provisions of Division 1.
- B. Coordinate the Work with termination of sanitary sewer connection outside building, connection to municipal sewer utility service, and trenching.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Plastic Pipe: ANSI/ASTM D3034, Type PSM, Polyvinyl Chloride (PVC) material; inside nominal diameter as shown on the Drawings, bell and spigot style solvent sealed joint end.

2.02 PIPE ACCESSORIES

- A. Fittings: ASTM F477; rubber gasket bell and spigot type of same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.03 BEDDING AND COVERING MATERIALS

- A. Bedding: Type 1 as specified in Section 02225.
- B. Covering: Type 1 as specified under Section 02225.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.02 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine course aggregate.

- B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.03 BEDDING

- A. Excavate pipe trench in accordance with Section 02225 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level materials as specified under Section 02225.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.04 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.
- B. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- C. Install bedding at sides and over top of pipe as specified under Section 02225.
- D. Refer to Section 02225 for trenching requirements. Do not displace or damage pipe when compacting.
- E. Refer to Section 02607 for manhole requirements.
- F. Connect to municipal sewer system.

3.05 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Request inspection prior to and immediately after placing bedding.
- C. Compaction testing will be performed in accordance with Sections 02223 and 02225.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

- E. Pressure Test: Perform low pressure air test on sanitary sewer. In accordance with City Sewer Specifications.
- F. Deflection Test: Perform deflection test on sanitary sewer. Include requirements per City Sewer Specifications.
- G. Vacuum Test: Perform vacuum test on sanitary manholes in accordance with Section 02607.

3.06 PROTECTION

- A. Protect finished installation under provisions of Division 1.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 03300

CONCRETE WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formwork, shoring, bracing, and anchorage.
- B. Concrete reinforcement and accessories.
- C. Cast-in-place concrete.

1.02 REFERENCES

- A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.
- B. ACI 301 - Specifications of Structural Concrete for Buildings.
- C. ACI 305 - Hot Weather Concreting.
- D. ACI 306 - Cold Weather Concreting.
- E. ACI 315 - Details and Detailing of Concrete Reinforcement.
- F. ACI 318 - Building Code Requirements for Reinforced Concrete.
- G. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- H. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- I. ASTM C33 - Concrete Aggregates.
- J. ASTM C94 - Ready-Mixed Concrete.
- K. ASTM C150 - Portland Cement.
- L. ASTM C260 - Air Entraining Admixtures for Concrete.
- M. ASTM C309 - Liquid Membrane - Forming Compounds for Curing Concrete.
- N. ASTM C494 - Chemical Admixtures for Concrete.

- O. ASTM C618 - Fly Ash as Admixture for Concrete.
 - P. ASTM C779 - Standard Test Method for Abrasion of Horizontal Concrete Surfaces.
- 1.03 SUBMITTALS
- A. Submit shop drawings of reinforcing steel under provisions of Section 01300.
 - B. Initial submittal of reinforcement shop drawings shall be complete. No partial submittals will be accepted.
 - C. Indicate reinforcement sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules and splicing, supporting, and spacing devices.
 - D. Reinforcement placement shop drawings for foundations and walls shall conform to ACI SP-66 providing full wall elevations.
 - E. Submit six (6) copies of proposed mix design of each class of concrete to Architect/Engineer for review prior to placing any concrete. Mix design shall include brands, types, and quantities of admixtures included.
- 1.04 QUALITY ASSURANCE
- A. Perform work in accordance with ACI 301, 305, 306.
 - B. Maintain copy of ACI 301 on site.
- 1.05 REGULATORY REQUIREMENTS
- A. Conform to requirements of local, State, and Federal rules and regulations applicable to Work and Project location.
- 1.06 ENVIRONMENTAL REQUIREMENTS
- A. Placement and curing of concrete where (1) average daily temperature for three consecutive days is less than 40 degrees F, and (2) air temperature is not greater than 50 degrees F for more than one-half of a twenty-four hour period from midnight to midnight shall be in accordance with ACI 306.

- B. Placement and curing of concrete subject to a combination of rising air temperature (generally greater than 75 degrees F) and low relative humidity and wind shall be in accordance with ACI 305.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Conform to ACI 301.
- B. Plywood Forms: Douglas Fir or Spruce species: sound, undamaged sheets with clean true edges, exterior glue, facing material to provide finish specified.
- C. Lumber: Douglas Fir or Spruce species; Construction grade or better; with grade stamp clearly visible.
- D. Preformed Steel Wall Forms: Minimum 16 gage thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and surface appearance.
- E. Form Ties For Exposed Surfaces: Plastic cone snap ties with 1-inch outside diameter by 1-inch (nominal) long cones, with no metal within 1-inch of concrete face after removal; Manufactured by Dayton Superior, Richmond Screw Anchor Co., or an approved equal.
- F. Form Ties For Hidden Surfaces: Metal spreader type, removable to a depth of 1 inch from concrete face; Manufactured by Dayton Superior, Richmond Screw Anchor Co., or an approved equal.

2.02 REINFORCING STEEL

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade billet steel deformed bars; uncoated finish.
- B. Welded Steel Wire Fabric: Plain type, ASTM A185; in flat sheets, uncoated finish.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150, Portland, grey color, Type as specified under Article 2.07 Concrete Mix.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.

2.04 CHEMICAL ADMIXTURES

- A. Chemical admixtures shall be used in accordance with ASTM C494.
- B. Concrete may contain a Type A Water-reducing admixture.
- C. Admixtures are to be used in accordance with manufacturer's recommendations.
- D. Chemical admixtures containing chlorides, sulfides, or nitrides are not permitted.
- E. Admixtures permitted shall be supplied by a single manufacturer.
- F. Admixture manufacturer's are to be approved by Architect/Engineer prior to use.

2.05 ADMIXTURES

- A. Air Entrainment Admixture: ASTM C260.
- B. Fly Ash: Class C in accordance with ASTM C618.

2.06 ACCESSORIES

- A. Waterstops: Stainless steel, 20 gage minimum, as manufactured by Westec or approved equal.
- B. Compressible Joint Filler: ASTM D1751, Bituminous fiber, 1/2-inch-wide by depth of concrete less 1/2-inch.
- C. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete, as manufactured by Symons Company "Magic Coat"; W. R. Meadows "Duogard"; or Sonneborn "Castoff."

2.07 CURING MATERIALS

- A. Water: Potable and clean.

2.08 CONCRETE MIX

- A. Mix concrete in accordance with ASTM C94.

B. Schedule of Mixes:

<u>Class</u>	<u>Max. Agg. Size (in.)</u>	<u>Max. Slump (in.)</u>	<u>Min. Cement Sacks/cu.yd.</u>	<u>Min.Comp. Strength (psi/28 days)</u>	<u>Max. Water/Cement Ratio</u>
1	1-1/2	3	4.50	3000	0.60
6	3/4	3	5.75	4000	0.45
7	3/4	5	6.00	4000	0.48

* Air Entrained Concrete Mix in Accordance with ASTM C226.
Air content of 5 Percent for air entrained concrete.

Slump Tolerance - 3-inch slump, plus 1-inch minus 1/2-inch.
5-inch slump, plus or minus 1-inch.

1	Footings	3000 psi
1	Interior slabs on grade.	4000 psi
7	Retaining walls, structural walls, dock walls.	4000 psi

C. Type of cement to be used in concrete mix shall be as follows:

Type I	Mix Class 1, 6, 7
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- D. Mix designs for concrete shall be Contractor-designed at its expense. Designs shall be prepared by a qualified agency approved by Architect/Engineer. Six (6) copies of mix designs shall be submitted for Architect/Engineer's review prior to placing any concrete and shall indicate completely brands, types, and quantities of admixtures included. Contractor shall design mixes to assure placing and finishing characteristics that meet Project requirements.
- E. Minimum cement contents listed in Schedule of Mixes are based on use of water reducing agents specified. Mixes without water reducing agents will require a 12 percent increase in cement contents.
- F. Minimum cement content in mixes listed above, except mix 1, may be reduced by 1 sack per cubic yard if 100 pounds of fly ash is added to each cubic yard of concrete. Cement content for mix 1 may only be reduced by 1/2 sack per cubic yard if 100 pounds of fly ash is added to each cubic yard of concrete.

PART 3 EXECUTION

3.01 FORMWORK ERECTION

- A. Verify lines, levels, and measurement before proceeding with formwork.
- B. Earth forms are not permitted.
- C. Align form joints.
- D. Do not apply form release agent where concrete surfaces receive applied coatings which may be affected by agent.
- E. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

3.02 REINFORCEMENT

- A. Place, support, and secure reinforcement against displacement.
- B. Locate reinforcing splices as shown on Drawings.

3.03 PLACING CONCRETE

- A. Notify Engineer a minimum of 24 hours prior to commencement of concrete operations.
- B. Failure to notify Engineer may result in rejection of concrete placed without observation.
- C. Place concrete in accordance with ACI 301.
- D. Ensure reinforcement and embedded items are not disturbed during concrete placement.
- E. Excessive honeycomb or embedded debris in concrete is unacceptable and will result in concrete being rejected and replaced at no cost to OWNER.
- F. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- G. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.04 FLOOR SLABS

- A. Place floor slabs on grade with construction joints as shown on Drawings.
- B. Joints between adjacent pours shall be as detailed on the Drawings.
- C. Separate slabs on fill from vertical surfaces with compressible joint filler.
- D. Extend joint filler from bottom of slab to within 1/2-inch of finished slab surface.
- E. Immediately after finishing begin curing.

3.05 TOLERANCES

- A. Tolerances for concrete work shall be in accordance with ACI 117.

3.06 FIELD QUALITY CONTROL

- A. Testing and analysis of concrete will be performed under provisions of Division 1.
- B. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.
- C. Three concrete test cylinders will be taken from each increment of 100 cubic yards of each class of concrete placed each day.
- D. One additional test cylinder will be taken during cold weather and be cured on site under same conditions as concrete it represents.
- E. One slump test will be taken for each set of test cylinders taken.

END OF SECTION

